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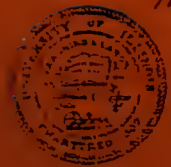
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PAPER NO. 862

On the Potential of Activist Demand Management
Under Rational Expectations

Peter Birch Sorensen

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On the Potential of Activist Demand Management
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ON THE POTENTIAL OF ACTIVIST
DEMAND MANAGEMENT UNDER
RATIONAL EXPECTATIONS

by Peter Birch Sorensen

This paper argues that a tradeoff between output and anticipated inflation is consistent with rational behavior of the private sector. A Phillips curve embodying such a tradeoff is incorporated into a short run macroeconomic model with rational expectations to demonstrate the "real" effects of anticipated fiscal and monetary policies. The short run effects of anticipated and unanticipated discretionary policies are derived and the potential of systematic feedback rules for fiscal and monetary policy is analyzed. Genuine countercyclical demand management is found to be optimal for parameter values consistent with the traditional Keynesian view of the world.

1. The Current State of the Policy Neutrality Debate

A decade after it was first advanced, the proposition that systematic government demand management can have no impact on output and employment continues to be the subject of heated dispute among economists.

The most well-known statements of this policy ineffectiveness proposition are those of Sargent and Wallace (1975), (1976) and Barro (1976), although the main conclusions of these papers had already been drawn by Lucas (1972). The most important assumptions leading to the policy neutrality postulates of these seminal contributions were the following ones:

(a) Expectations are "rational" in the sense that the subjective probability distributions of economic variables estimated by economic agents at time t coincide with the true objective probability distributions of these variables conditional upon all the information available to the public at time t . In particular, this implies that the private sector will detect any systematic stabilization policy rule and anticipate its effects on the economy.

(b) The natural rate hypothesis (NRH) applies, i.e., the equilibrium rate of output and employment is independent of the equilibrium rate of inflation.

(c) Wages and prices respond instantaneously to notional excess demand so that all markets are continuously clearing. Together, (b) and (c) imply that output can deviate from its "natural" level only when the expected rate of inflation differs from the actual inflation rate.

(d) The information set available to the public is the same as that available to policy-makers, that is the private sector knows just as much about the structure of the economy, current economic trends and the intentions of policy-makers as do the authorities themselves.

Of course the radical policy ineffectiveness postulate had to provoke a counterattack from economists brought up in a Keynesian tradition according to which the private sector can be and needs to be stabilized. Thus criticisms have been raised against points (a), (c) and (d) above.

Benjamin Friedman (1979) has argued that economic agents--including professional forecasters--cannot realistically be expected to know the true structure of the economy. The hypothesis of rational expectations involves two assumptions: (1) Private agents use efficiently whatever information is available to them, and (2) the available information includes perfect knowledge of the economic structure. The latter assumption ignores the fact that knowledge of the workings of the economy has to be acquired through a time-consuming process of learning. During the learning process there will be deviations between the estimated and the true parameter values in a correctly specified model of the economy. As a result there will be forecast errors, even if all the predetermined variables--including government policy variables--are fully known. These forecast errors will vary systematically with the magnitude of the predetermined variables (Friedman, op. cit. pp. 29-30). It follows that the amount of unanticipated inflation--and consequently the deviation of output from its "natural" level--will depend inter alia on anticipated government policy.

One of the reasons why we shall probably never gain exact knowledge of the economic structure is that this structure changes over time. Whenever a structural shift has taken place due, say, to a major institutional or technological change, rational forecasters should revise their model of the economy. Generally, however, there is no way of inferring the true parameter values of the new model from data relating to the past. Depending on the particular method applied by the economic agents to infer the new structure of the economy, the system may or may not converge towards a new rational expectations equilibrium in which expectations are consistent with the currently correct model (Shiller, 1978, pp. 37-39). Even apart from possible problems of instability, convergence may be so slow that the economy is never close to a rational expectations equilibrium, since new structural changes keep on occurring.

One might also point to the non-uniqueness problems associated with some rational expectations models and discussed by Taylor (1977) and Shiller (op. cit.). If the "true" model of the economy does not yield a unique solution when agents base their expectations on their knowledge of this model, how can individual agents make optimal forecasts?

In spite of these difficulties with the rational expectations hypothesis, it has now become widely accepted, presumably because of the lack of any convincing alternative theory of expectations formation. Instead many economists have directed their criticism against the postulate that the economy can be usefully modelled "as if" all markets are continuously clearing.

Fischer (1977) and Taylor (1979) have constructed rational expectations models in which the existence of multi-period wage contracts enable policy-makers to influence output and employment through a monetary feed-back rule. By reacting to stochastic (unforseeable) demand and supply shocks which have occurred after some of the current wage contracts were negotiated, the monetary authority can influence real wages, the amount of unanticipated inflation and through these channels the quantity of output supplied. Phelps and Taylor (1977) and Buiter (1980) also present models in which prices do not adjust instantaneously to notional excess demand, leaving room for anticipated, policy-induced changes in nominal demand to affect quantities as well as prices. Even a monetarist like Laidler (1981), who does not favor activist demand management, has criticized the market clearing assumptions of Lucas, Sargent, Wallace and Barro. He points to the various types of quantity rationings occurring during business cycles as evidence that prices rarely (if ever) assume their Walrasian equilibrium values.

Although there may still be disagreements whether and to what extent assumption (d) is violated, all contributors to the rational expectations literature agree that policy-makers may in principle exploit a possible information advantage to stabilize output. If the authorities can obtain and react to new information faster than the private sector, systematic demand management can be used to offset the various shocks impinging upon the economy. Taylor (1975) argues that even though policy-makers may not know more about the structure of the economy than the private sector, they are at least likely to be better informed about their own intentions, i.e., about the policy-rule they

apply. He shows that systematic monetary policy can have "real" effects during the period until the private sector has figured out the monetary policy rule from experience.

Anticipated stabilization policy may have beneficial "real" effects in cases other than the ones mentioned above. Shiller (op. cit. pp. 12-13) notes that if there are significant non-linearities in some behavioral economic relationships, these may be exploited for stabilization purposes. He provides a specific example of a non-linear rational expectations model, in which complete stabilization of output is possible.

The simple models embodying the policy neutrality proposition usually assume the current price level to be unknown to investors at the time of the investment decision. Turnovsky (1980) shows that if instead one assumes the current price level to be fully known, the monetary authority can ensure complete stabilization of output even when all the assumptions (a) through (d) are met.

In the light of all these criticisms it seems hard to defend the strong proposition that anticipated government demand management generally leaves output and real interest rates unaffected. Still, none of these criticisms provides any strong support for policy activism, as I shall now argue.

Ben Friedman is undoubtedly right in claiming that private economic agents (including professional forecasters) do not in practice know the true parameter values of the relevant model of the economy--probably they do not even feel sure how the "relevant" model should be specified. However, for policy-makers to be able to exploit the discrepancies

between the estimated and the true parameter values for purposes of systematic stabilization, they must know more than the private sector about the true model of the economy. In other words, as Friedman himself recognizes (1979, p. 37), assumption (d) must be violated. It may be that the authorities have superior information on at least their own policy intentions, especially in a period following a change in the policy regime, but in order to derive predictable stabilization effects from this information advantage they must know precisely how their own information differs from that of the public. Similarly, to take advantage of the possible non-linearities mentioned by Shiller, policy-makers would have to know the specific character of these non-linearities.

It is far from obvious that the authorities possess this knowledge. Instead of trying to exploit possible information advantages through activist demand management, it would seem more safe for policy authorities simply to share all their information with the public, including information on their own policy plans. This would enable private agents to make better inflation forecasts, thereby reducing unanticipated inflation and the ensuing deviations of output from its equilibrium trend level.

At first sight the model of Turnovsky would seem to provide a case for policy activism. However, the strong non-neutrality implication of this model rests crucially on the assumption that current investment expenditure is a function of the current real interest rate. In the kind of short run model appropriate for the analysis of short run stabilization policy it is more reasonable to assume that current investment expenditure is predominantly a result of investment decisions taken prior

to the current period, and in that case Turnovsky's non-neutrality proposition breaks down (this point is elaborated in Sections 3 and 4).

The strongest argument in favor of countercyclical demand management is probably that which relies on the apparent failure of the price mechanism to ensure continuous market clearing. Though I believe that this argument carries considerable weight, the contributions of McCallum (1978 and 1980) have shown that price stickiness in itself does not necessarily invalidate the policy ineffectiveness proposition. Buiter (op. cit.), who is very critical of the policy neutrality view, satisfies himself with the fact that "... it is very simple to construct quite plausible models with sluggish wage or price adjustment that do leave scope for real effects of deterministic monetary and fiscal policy" (p. 45). Still, given our present ignorance about actual wage and price formation, what one economist considers a "plausible" model of wage-price behavior might be considered implausible by another. Until we know whether a Buiter-type or a McCallum-type model of the wage-price sector is the more realistic one, we cannot be sure that systematic demand management has significant real effects, provided we feel compelled to accept the NRH which is embodied in both types of models.

At present it thus seems that one would have to argue against the NRH to provide a convincing case for policy activism. This paper attempts to do so by restating some criticisms of the NRH developed at length elsewhere (Sorensen, 1982, a and b), and by incorporating a "Keynesian" Phillips curve into a simple macroeconomic model with rational expectations to show the potential of activist stabilization

policy. To my knowledge none of the authors engaged in the policy-neutrality debate are currently challenging the NRH--at least this hypothesis has been embodied in all the formal models developed during the debate. There are probably several reasons for this:

First, it is widely believed that invalidity of the NRH must imply the existence of some kind of money illusion, and of course it would be highly inconsistent to introduce such irrational behavior into a model where expectations are formed rationally.

Second, the NRH is analytically convenient in formal models, and this may have tempted many authors to accept it in the absence of any strong theoretical arguments against it.

Third, it may seem intuitively obvious that the policy-neutrality proposition will break down if the NRH is invalid, and the need for a formal demonstration of this result may not have been felt.

Still, if there is no unique "natural" rate of unemployment, it seems worthwhile to ask exactly what activist stabilization policy can achieve under such circumstances. A simple macro model with rational expectations is set up below to analyze this question. At first, however, we must seek to justify our dismissal of the NRH.

2. The Natural Rate Hypothesis Reconsidered

This section gives a brief and simplified restatement of some arguments against the NRH, which I have spelled out in detail elsewhere.

In Sorensen (1982a) I set up a model of an atomistic labor market where wage rates are set by individual firms and workers are "wage

takers."¹ The behavior of workers employed by the i th firm is governed by the variable

$$R_t^i = W_t^i / [(1-u_t)W_t^e + u_t B_t] \quad (2.1)$$

where W_t^i is the wage rate offered by the i th firm, u_t is the unemployment rate, W_t^e is the expected average wage rate in the labor market and B_t is the (hourly) rate of unemployment compensation, all variables relating to "year" t . The denominator of (2.1) is the expected income for the average worker in year t , given prevailing employment opportunities, and R_t^i is thus a measure of the relative earnings offered by the i th firm. Unemployment benefits are assumed to adjust to actual wage development with a lag, so that $B_t = aW_{t-1}$, where W_{t-1} is the actual average wage rate in the preceding year, and a is a policy-determined constant.

It is argued that, *ceteris paribus*, the i th firm will experience lower costs of labor turnover and higher labor productivity, the higher the value of R_t^i . Further, it is shown that cost minimization requires the firm to set its wage rate so that $R_t^i = K$, where K is a constant the magnitude of which depends on the parameters of the functions relating turnover costs and productivity to R_t^i . Now, let the i th firm be a representative one, implying that $W_t^i = W_t$ for all t . Moreover, define the actual rate of wage inflation as $w_t = (W_t - W_{t-1})/W_{t-1}$ and the expected rate as $w_t^e = (W_t^e - W_{t-1})/W_{t-1}$.² We may then write

¹The model shares many characteristics with that of Phelps (1968).

²This definition assumes that last year's wage level is fully known in the current year.

$$R_t^i = (1+w_t)/[(1-u_t)(1+w_t^e) + u_t a] = K \quad (2.2)$$

Assume that we start out from an equilibrium situation in which $w_t^e = w_t$, and let w_t^e rise by some amount X . It is easy to see from (2.2) that the representative firm will then need to raise its rate of wage increase w_t by less than X to keep relative earnings at their constant optimum value K . To restore equality between w_t^e and w_t , u_t would thus have to fall, thereby inducing a further rise in w_t . In other words, in equilibrium a higher rate of wage inflation would be associated with a lower rate of unemployment. This result obviously contradicts the NRH, according to which only one unemployment rate is compatible with equilibrium. The existence of a time lag in the adjustment of unemployment benefits to changes in the wage level is sufficient to produce a long run tradeoff between inflation and unemployment. The NRH can be shown to be valid in the special case of instantaneous and proportionate adjustment of benefits to wage changes, but that case seems empirically unrealistic.

In another paper I have tried to develop a model of wage and price determination in an imperfectly competitive world with unions and oligopolistic and monopolistic firms (Sorensen, 1982b).³ The rate of wage inflation in the basic model of the paper is given by the equation

$$(w_t - w_{t-1})/w_{t-1} = n_t^\sigma (w_t^D - w_{t-1})/w_{t-1}, \quad \sigma \geq 0 \quad (2.3)$$

³The model is inspired by that of Turnovsky and Pitchford (1978).

where W is again the actual average money wage, W^D is the money wage demanded by unions and n is the rate of employment, which is always between zero and one. (2.3) thus postulates that actual wage inflation is some fraction n^σ of the percentage wage increase demanded by unions, with this fraction varying positively with excess demand for labor, proxied by the employment rate. The rate of price inflation is

$$(P_t - P_{t-1})/P_{t-1} = n_t^\gamma (P_t^D - P_{t-1})/P_{t-1}, \quad \gamma \geq 0 \quad (2.4)$$

where P is the actual price level and P^D is the target price of the representative oligopolistic firm. With a rise in the employment rate, excess capacity will generally fall and firms will find it easier to realize their target prices. This is the rationale for (2.4).

The paper then proceeds to specify equations for W_t^D and P_t^D . It is assumed that target wages and prices reflect a desire of workers and firms to obtain a certain level of real wages and real profits, respectively, and that these real income claims vary positively with the employment rate. Thus there is no money illusion in the model. It is then shown that a higher employment rate generally implies a higher equilibrium inflation rate. The NRH will hold only when the parameters σ and γ are both equal to zero, so that target wages and prices are always realized. This must be considered an unlikely special case which would seem to require an extreme degree of monopoly in the markets for goods and labor.

To sum up: The existence of a downward sloping long run Phillips curve does not seem to rely on money illusion in the private sector.

3. A Simple Model of Price and Output Interactions

We are now ready to analyze the potential of activist demand management under rational expectations. For this purpose, we shall employ the following short run model

$$Y_t = aY_t - b[r_{t-1} - ({}_{t-1}P_t^* - P_{t-1})] + G_t + u_{1t}, \quad 0 < a < 1 \quad (3.1)$$

$$M_t - M_{t-1} = P_t - P_{t-1} + \alpha(Y_t - Y_{t-1}) - \beta(r_t - r_{t-1}) + u_{2t} \quad (3.2)$$

$$P_t - P_{t-1} = \eta + \gamma(Y_t - \bar{Y}) + \lambda({}_{t-1}P_t^* - P_{t-1}) + u_{3t}, \quad 0 < \lambda < 1 \quad (3.3)$$

$$G_t = g_t + \delta(\bar{Y} - Y_{t-1}) \quad (3.4)$$

$$M_t - M_{t-1} = m_t + \mu(\bar{Y} - Y_{t-1}) \quad (3.5)$$

where

Y_t = real output

$\bar{Y}$ = full employment level of real output

G_t = real government consumption

r_t = nominal interest rate

M_t = nominal money supply, measured in logarithms

P_t = price level, measured in logarithms

${}_{t-1}X_t^*$ = expectation of variable X, held at time t-1 for time t

We have chosen signs so that all parameters are positive. Equation (3.1) is our IS curve. It is fairly standard, except perhaps that we take private sector demand to vary negatively with last period's real interest rate (the term in the square bracket) and not with the current

rate. We shall discuss this specification in detail in a moment. Equation (3.2) is a dynamic version of the equilibrium condition for the money market. It is simply the first difference of the static equilibrium condition $M_t - P_t = \omega + \alpha Y_t - \beta r_t + z_{2t}$, where $u_{2t} \equiv z_{2t} - z_{2t-1}$. Following Turnovsky (1980), we have measured the money supply and the price level in logarithms. This is purely for convenience, in order to avoid the linearization which would otherwise be necessary. (3.3) is a simple, expectations-augmented Phillips curve. The parameter η captures possible "cost-push" inflation, but it is inessential to our general conclusions that it be strictly positive. The assumption that λ falls short of unity of course reflects our break with the NRH.⁴ Relations (3.4) and (3.5) hypothesize that government expenditure and monetary growth are increased (decreased) to the extent that last period's output fell short of (exceeded) its full employment level. The assumption of lagged policy responses is justified by the recognition, decision and implementation lags inherent in the political process. It also reflects our wish to avoid assigning an information advantage to government. The exogenous variables g_t and m_t capture "discretionary" fiscal and monetary policies. The random disturbances u_{1t} and u_{2t} reflect stochastic shifts in the demand for

⁴ Actually the models referred to in the preceding section both imply the Phillips curve to be nonlinear. (3.3) is thus a linear approximation adopted to keep the whole system linear.

Most recent empirical studies (e.g., Fields and Noble, 1981) suggest a value of λ insignificantly different from one. My 1982 papers argue that these estimates of λ are upward biased because the explanatory variables of the regression equations do not include tax rates and unemployment compensation, which can be shown to be inflationary within the framework of my models.

goods and real balances, respectively, and u_{3t} captures random supply shocks. Following convention, we assume all the u 's to have zero means, finite variances and covariances, and to be independently distributed over time. Government expenditures and the money supply are assumed to be perfectly controllable, a simplifying but--for our purposes--inessential assumption.

There has been some disagreement over the proper specification of the real interest rate in models like the present one. Denoting the real interest rate in period t by ℓ_t , some authors like Sargent and Wallace (1975) and MacCallum (1980) employ the definition $\ell_t = r_t - ({}_{t-1}P_{t+1}^* - {}_{t-1}P_t^*)$. Investment decisions in period t are thus assumed to be based on inflationary expectations formed at the end of period $t-1$. In other words it is postulated that whereas the nominal interest rate is fully known at the time of the investment decisions, the current price level is not. Turnovsky (1980, pp. 42-43) finds this postulate to be inconsistent with the standard assumption that the demand for money depends on the actual rather than the expected price level, and consequently he adopts the specification $\ell_t = r_t - ({}_tP_{t+1}^* - P_t)$. Minford and Peel (1981) argue that the inconsistency pointed out by Turnovsky is imaginary. One needs only assume that the transactions demand for money is based on the actual prices observed by individual agents. On aggregation one then obtains a money demand function in which the actual aggregate price level appears. In an economy where agents have current information only on the local prices they observe rather than on the general price level, one ends up with a Sargent-Wallace specification of the real interest rate along with a traditional

money demand function, according to Minford and Peel. This argument seems flawed, however. What determines the profitability of the investment project of an individual firm is not the development of the general price level, but rather the change of the price of the firm's own product. The investment decision of the i th firm will therefore depend on the variable $r_t - (P_{t+1}^{i*} - P_t^i)$, where the term in the bracket is (approximately) equal to the expected percentage increase in the price of the firm's product.⁵ Aggregating over firms we arrive at Turnovsky's specification $\ell_t = r_t - (P_{t+1}^* - P_t)$, although via a different route than his.

Using this specification of ℓ_t in a simple macro model, Turnovsky showed that proper monetary policy parameters can ensure complete stabilization of output even if the NRH is valid ($\lambda=1$) and the government has no information advantage. While this result seriously questions the robustness of the policy neutrality proposition, it would also seem to undermine the importance of the NRH for that proposition. However, Turnovsky's result depends critically on current demand for goods being a function of the current real interest rate. Though very common, this assumption is unrealistic in a model dealing with short run stabilization policy, given the considerable lags in the investment process documented by Mayer (1960) and Hall (1977). Summing up these findings, Kydland and Prescott (1980, p. 176) conclude that "... only a small fraction of additions to capital stock that are decided upon in a given year show up as investment expenditures in the same year. Most of the expenditures will be incurred

⁵Remember that prices are measured in logarithms.

during the next year, with a not insignificant fraction being left over for the subsequent year." This is the rationale for our IS curve (3.1).⁶ It would be easy to include more than a one-period investment lag by letting aggregate demand depend on the real interest rates of several past periods, but that would only complicate the exposition without affecting our conclusions on short run policy effects.

Our model still misses an equation describing the formation of inflationary expectations. Assuming these to be rational, this equation is derived by substituting (3.4) into (3.1), solving for Y_t and inserting the resulting expression into (3.3) to get

$$P_t - P_{t-1} = [\gamma/(1-a)]\{g_t + \delta(\bar{Y} - Y_{t-1}) - b[r_{t-1} - ({}_{t-1}P_t^* - P_{t-1})] + u_{1t}\} \\ + \eta - \gamma\bar{Y} + \lambda({}_{t-1}P_t^* - P_{t-1}) + u_{3t}$$

Taking expectations of this expression conditional upon all information available up through period $t-1$, we then find the expected rate of inflation to be

$${}_{t-1}P_t^* - P_{t-1} = \{\eta(1-a) + \gamma[{}_{t-1}g_t^* + (\delta-1+a)\bar{Y} - \delta Y_{t-1} \\ - br_{t-1}]\}/[(1-\lambda)(1-a) - \gamma b] \quad (3.6)$$

The recursive structure of our model is now clear: Given last period's interest rate and the expected level of autonomous government

⁶Brems (1982, pp. 77-80) also provides evidence of a one year lag between the real interest rate (measured by the common stock yield) and private investment.

expenditure, ${}_{t-1}g_t^*$, equations (3.6), (3.4) and (3.1) determine current output, which is then inserted into (3.3) along with (3.6) to give the current inflation rate. With monetary growth being dictated by last period's output according to (3.5), the monetary equilibrium condition (3.2) finally determines the current interest rate, given the growth of output and prices.

Assuming for the moment that g_t and m_t are kept constant so that $g_t = {}_{t-1}g_t^* = \bar{g}$ and $m_t = \bar{m}$, we can reduce the system (3.1) through (3.6) to the following difference equation in output:⁷

$$Y_{t+2} + C_1 Y_{t+1} + C_2 Y_t = C_0 + u_{1t+2} + v u_{t+1} \quad (3.7)$$

$$C_1 \equiv \{(1-\lambda)[b(\alpha+\gamma) + \beta(\delta-1+a)] + \gamma b(\lambda+\beta)\}/\theta\beta$$

$$C_2 \equiv (1-\lambda)[b(\mu-\alpha) - \delta\beta]/\theta\beta$$

$$C_0 \equiv b[(1-\lambda)(\bar{m}+\mu\bar{Y}) + \gamma\bar{Y} - \eta]/\beta\theta$$

$$\theta \equiv (1-\lambda)(1-a) - \gamma b$$

$$v \equiv [(\theta\beta-\gamma\lambda b)/\theta\beta, b(1-\lambda)/\theta\beta, b(1-\lambda)/\theta\beta]$$

$$u_t \equiv [u_{1t}, u_{2t}, u_{3t}]$$

⁷ A mathematical appendix giving a detailed derivation of the results of this paper are available from the author on request.

where u'_{t+1} is the transpose of the vector u_{t+1} . The necessary and sufficient conditions for stability are

$$1 + c_1 + c_2 > 0 \quad (3.8)$$

$$1 - c_1 + c_2 > 0 \quad (3.9)$$

$$1 - c_2 > 0 \quad (3.10)$$

Using the definitions stated in (3.7), condition (3.8) is found to imply that

$$b[\gamma + \mu(1-\lambda)] / \beta[(1-\lambda)(1-a) - \gamma b] > 0 \quad (3.8.a)$$

If monetary policy is indeed countercyclical ($\mu > 0$), (3.8.a) requires that $(1-\lambda)(1-a) > \gamma b$. In other words, the responsiveness of prices to excess supply (γ) and the sensitivity of investment to interest rates (b) must be "low." These requirements are in accordance with the traditional "Keynesian" view of the world and would seem to fit well in with our "Keynesian" Phillips curve (3.3). The parameter a , which is the marginal propensity to consume out of pretax income, may be influenced by tax policy. Under a simple proportional income tax system we have $a = d(1-\tau)$, where d is the marginal propensity to consume out of disposable income, and τ is the tax rate. In conformity with standard theory, we thus find the likelihood of stability to be greater, the higher the tax rate. In the policy analysis below, we shall assume the stability condition (3.8.a) to be met. In Section 5 we shall return to the stability problem and show that government can always ensure stability by an appropriate choice of policy parameters.

4. Short Run Policy Effects

Before turning to the problem of optimum stabilization policies, let us analyze the short run impact of discretionary fiscal and monetary policies. Substituting (3.4) into (3.1) and (3.5) into (3.2) and using the definition $g_t \equiv {}_{t-1}g_t^* + g_t^u$, where g_t^u denotes the unanticipated component of g_t , our model may be rewritten as follows:⁸

$$(1-a)Y_t - b {}_{t-1}\dot{P}_t^* = {}_{t-1}g_t^* + g_t^u + \delta(\bar{Y} - Y_{t-1}) - br_{t-1} + u_{1t},$$

$${}_{t-1}\dot{P}_t^* \equiv {}_{t-1}P_t^* - P_{t-1} \quad (4.1)$$

$$\alpha Y_t + \dot{P}_t - \beta r_t = m_t + \mu(\bar{Y} - Y_{t-1}) + \alpha Y_{t-1} - \beta r_{t-1} - u_{2t},$$

$$\dot{P}_t \equiv P_t - P_{t-1} \quad (4.2)$$

$$\gamma Y_t - \dot{P}_t + \lambda {}_{t-1}\dot{P}_t^* = \gamma \bar{Y} - \eta - u_{3t} \quad (4.3)$$

$${}_{t-1}\dot{P}_t^* = \{\eta(1-a) + \gamma[{}_{t-1}g_t^* + (\delta-1+a)\bar{Y} - \delta Y_{t-1} - br_{t-1}]\}/\theta \quad (4.4)$$

We can now apply Cramer's rule to the above linear system to solve for Y_t , r_t , $\dot{P}_t$ and ${}_{t-1}\dot{P}_t^*$ in terms of the lagged endogenous variables, the policy parameters and the random demand and supply shocks. From these solutions one finds the impact effect of discretionary fiscal policy to be

⁸ The reason why we do not yet distinguish between anticipated and unanticipated money will be clear in a moment.

$$\partial Y_t / \partial g_{t-1}^* = (1-\lambda)/\theta > 0 \quad (4.5)$$

$$\partial Y_t / \partial g_t^u = 1/(1-a) > 0 \quad (4.6)$$

$$(\partial Y_t / \partial g_{t-1}^*) - (\partial Y_t / \partial g_t^u) = \gamma b / \theta (1-a) > 0 \quad (4.7)$$

$$\partial \dot{P}_{t-1}^* / \partial g_{t-1}^* = \gamma / \theta > 0 \quad (4.8)$$

$$\partial \dot{P}_{t-1}^* / \partial g_t^u = 0 \quad (4.9)$$

$$\partial \dot{P}_t / \partial g_{t-1}^* = \gamma / \theta > 0 \quad (4.10)$$

$$\partial \dot{P}_t / \partial g_t^u = \gamma / (1-a) > 0 \quad (4.11)$$

$$(\partial \dot{P}_t / \partial g_{t-1}^*) - (\partial \dot{P}_t / \partial g_t^u) = \gamma [\lambda(1-a) + \gamma b] / \theta (1-a) > 0 \quad (4.12)$$

$$\partial r_t / \partial g_{t-1}^* = [\alpha(1-\lambda) + \gamma] / \beta \theta > 0 \quad (4.13)$$

$$\partial r_t / \partial g_t^u = (\alpha + \gamma) / \beta (1-a) > 0 \quad (4.14)$$

$$(\partial r_t / \partial g_{t-1}^*) - (\partial r_t / \partial g_t^u) = \gamma [\lambda(1-a) + b(\alpha + \gamma)] / \beta (1-a) \theta > 0 \quad (4.15)$$

In signing the multipliers where $\theta \equiv (1-\lambda)(1-a) - \gamma\beta$ appears, we have invoked the Samuelsonian correspondence principle, noting from (3.8.a) that stability requires θ to be positive. Relation (4.5) shows that a fully anticipated increase in government expenditure is expansionary to the extent that the NRH is invalid ($\lambda < 1$). (4.6) is

identical to the conventional multiplier from the static Keynesian model of basic textbooks. Our model shows it to be a first-period multiplier applying only to unanticipated changes in government expenditure. According to (4.7) government should announce its intention to increase g_t well in advance, if it wishes to maximize the expansionary impact of rising expenditures. Relations (4.8) and (4.9) provide the explanation for this: Contrary to an unexpected rise in g_t , an anticipated rise in government demand will raise the expected inflation rate for period t , thereby driving down the real interest rate in period $t-1$ and boosting investment in period t . This result contrasts sharply with standard "natural rate theory," according to which only unanticipated changes in g_t can affect output, whereas anticipated changes merely affect nominal income. However, we see from (4.12) that a fully foreseen rise in g_t will in fact be more inflationary than an unexpected one, due to its greater expansionary effect on output and its positive impact on inflationary expectations. For similar reasons the anticipated rise in government demand will also have a larger positive effect on nominal interest rates, as shown in (4.15).

Turning now to monetary policy we first note from (3.1) that the ability of the monetary authority to influence output depends on its ability to control the real interest rate. Obviously current changes in money growth cannot affect current output, since aggregate demand depends on last period's real interest rate. For the same reason the much celebrated distinction between anticipated and unanticipated money is irrelevant in the present model. A monetary expansion, whether or not it comes as a surprise, changes the current interest rate but has

no immediate impact on output and inflation, due to the lagged response of investment to interest rates. Thus there is always time for the public to adjust their inflationary expectations to unexpected as well as expected changes in interest rates before these exert their influence on demand. With this in mind we find that

$$\partial r_t / \partial m_t = -1/\beta < 0 \quad (4.16)$$

$$\partial_t \dot{P}_{t+1}^* / \partial m_t = (\partial_t \dot{P}_{t+1}^* / \partial r_t) \times (\partial r_t / \partial m_t) = \gamma b / \beta \theta > 0 \quad (4.17)$$

$$\partial \lambda_t / \partial m_t = (\partial r_t / \partial m_t) - (\partial_t \dot{P}_{t+1}^* / \partial m_t) = (\lambda - 1)(1 - a) / \beta \theta < 0 \quad (4.18)$$

$$\partial Y_{t+1} / \partial m_t = -b(\partial \lambda_t / \partial m_t) / (1 - a) = b(1 - \lambda) / \beta \theta > 0 \quad (4.19)$$

$$\partial_t \dot{P}_{t+1} / \partial m_t = \gamma(\partial Y_{t+1} / \partial m_t) + \lambda(\partial_t \dot{P}_{t+1}^* / \partial m_t) = \gamma b / \beta \theta > 0 \quad (4.20)$$

From (4.18) and (4.19) we see how the "real" effects of monetary policy depend critically on invalidity of the NRH ($\lambda < 1$). The above relations also show that monetary policy becomes impotent in the limiting case of the "liquidity trap," where β tends to infinity.

The reader may doubt that $\theta \equiv (1 - \lambda)(1 - a) - \gamma b$ is in fact positive. When it is negative, the system will be unstable for $\mu > 0$, and the short run effects of anticipated policies will be "perverse," according to relations (4.5) through (4.20).⁹ However, the probability of

⁹When the NRH applies ($\lambda = 1$), we obviously have instability, according to (3.8.a). This is a common problem in rational expectations models incorporating the NRH. Usually it is "solved" by resorting to the ad hoc procedure of simply imposing stability on the system by leaving out the unstable components (roots) of the solutions for the endogenous variables.

"normal" responses to policy changes is increased if we introduce a real balance effect into our model to allow for the possibility of direct substitution between money and goods and for the impact of changes in base money on net private wealth. For simplicity we shall ignore the existence of a banking sector and treat all money as "outside money." Our modified IS curve may then be written as

$$Y_t = aY_t - b(r_{t-1} - {}_{t-1}\dot{P}_t^*) + G_t + h(M_t - P_t) + u_{1t} \quad (4.21)$$

Substituting (3.4) and (3.5) into (4.21) and using the definitions $P_t \equiv \dot{P}_t + P_{t-1}$ and $m_t \equiv {}_{t-1}m_t^* + m_t^u$, where m_t^u is the unanticipated component of discretionary monetary growth, we get

$$Y_t = aY_t - b(r_{t-1} - {}_{t-1}\dot{P}_t^*) + {}_{t-1}g_t^* + g_t^u + h[{}_{t-1}m_t^* + m_t^u + \mu(\bar{Y} - Y_{t-1}) + M_{t-1} - \dot{P}_t - P_{t-1}] + u_{1t} \quad (4.22)$$

To derive the expected inflation rate, we insert (4.22) into the Phillips curve (3.3), take conditional expectations as of time $t-1$ and rearrange to find

$$\begin{aligned} {}_{t-1}\dot{P}_t^* = \{ & (1-a)(n-\gamma\bar{Y}) + \gamma[{}_{t-1}g_t^* + (\delta+\mu h)(\bar{Y} - Y_{t-1}) - br_{t-1} \\ & + h({}_{t-1}m_t^* + M_{t-1} - P_{t-1})] \} / (\theta + \gamma h) \end{aligned} \quad (4.23)$$

The monetary equilibrium condition (4.2) may be rewritten as

$$\alpha Y_t + \dot{P}_t - \beta r_t = {}_{t-1}m_t^* + m_t^u + \mu(\bar{Y} - Y_{t-1}) + \alpha Y_{t-1} - \beta r_{t-1} - u_{2t} \quad (4.24)$$

The model consisting of (4.22) through (4.24) plus the Phillips curve (3.3) may then be solved to get

$$\partial Y_t / \partial g_{t-1}^* = (1-\lambda) / (\theta + \gamma h) > 0 \quad (4.25)$$

$$\partial Y_t / \partial g_t^u = 1 / (1-a + \gamma h) > 0 \quad (4.26)$$

$$(\partial Y_t / \partial g_{t-1}^*) - (\partial Y_t / \partial g_t^u) = \gamma(b - \lambda h) / (\theta + \gamma h)(1-a + \gamma h) \quad (4.27)$$

$$\partial Y_t / \partial m_{t-1}^* = h(1-\lambda) / (\theta + \gamma h) > 0 \quad (4.28)$$

$$\partial Y_t / \partial m_t^u = h / (1-a + \gamma h) > 0 \quad (4.29)$$

$$(\partial Y_t / \partial m_{t-1}^*) - (\partial Y_t / \partial m_t^u) = \gamma h(b - \lambda h) / (\theta + \gamma h)(1-a + \gamma h) \quad (4.30)$$

$$(\partial \dot{P}_t / \partial g_{t-1}^*) - (\partial \dot{P}_t / \partial g_t^u) = \gamma[\lambda(1-a) + \gamma b] / (\theta + \gamma h)(1-a + \gamma h) > 0 \quad (4.31)$$

$$(\partial \dot{P}_t / \partial m_{t-1}^*) - (\partial \dot{P}_t / \partial m_t^u) = \gamma h[\lambda(1-a) + \gamma b] / (\theta + \gamma h)(1-a + \gamma h) > 0 \quad (4.32)$$

As seen from (4.28) and (4.29), the distinction between anticipated and unanticipated money has now become important, because current real balances have an immediate impact on demand. Comparing (4.25) to (4.5) and (4.28) to (4.19) we see that introduction of a real balance effect increases the likelihood of a positive response of output to anticipated fiscal and monetary expansion, and the same can be shown to be true for the response of inflation and interest rates. In signing the above multipliers we have assumed that $\theta + \gamma h$ is in fact positive, which does

not necessarily require our earlier assumption of $\theta > 0$ to hold. From a comparison of (4.25) and (4.26) to (4.5) and (4.6) it is seen that fiscal expansions have a smaller positive impact on output when the real balance effect is active. The reason is that the inflationary impact of a fiscal expansion erodes real balances, with a consequential negative wealth effect on private demand.

It is interesting to note from (4.27) and (4.30) that one cannot predict which of the two kinds of fiscal and monetary expansion--anticipated or unanticipated expansion--will have the greater impact on output. Relations (4.31) and (4.32) provide the clue to the explanation: By being more inflationary, an anticipated fiscal or monetary expansion implies a greater "inflation tax" on real balances than an unanticipated one. This effect is contractionary and is captured by the term $-\lambda h$ in the numerator of (4.27) and (4.30). On the other hand, in contrast to an unanticipated rise in G_t or M_t , an anticipated one drives down the real interest rate through its impact on inflationary expectations, thereby stimulating investment. This expansionary effect is reflected by the presence of b in the numerators of (4.27) and (4.30). A priori one cannot say which of the two effects will dominate. This is another case where our model conflicts with natural rate theory. In the case of the NRH ($\lambda=1$) relations (4.27) and (4.28) reduce to

$$(\partial Y_t / \partial g_t^u) - (\partial Y_t / \partial_{t-1} g_t^*) = 1/(1-a+\gamma h) > 0 \quad (4.27.a)$$

$$(\partial Y_t / \partial m_t^u) - (\partial Y_t / \partial_{t-1} m_t^*) = h/(1-a+\gamma h) > 0 \quad (4.30.a)$$

The empirical work of Barro (1977 and 1978) suggests that $\partial Y_t / \partial m_t^u > \partial Y_t / \partial m_{t-1}^*$. From (4.27.a) we see this to be consistent with the NRH,¹⁰ but according to (4.30) it is also consistent with our "Keynesian" model if $\lambda h > b$, i.e., if investment is relatively insensitive to real interest rates.

Finally, let us note that $\lambda = 1$ implies

$$\partial \ell_{t-1} / \partial m_{t-1}^* = -\partial \dot{p}_t^* / \partial m_{t-1}^* = h/(h-b) \neq 0 \quad (4.33)$$

Thus, even on his own natural rate premises, the conclusion of Friedman (1968, p. 11) that the monetary authority cannot use its control over a nominal variable to peg a "real" variable does not hold when the real balance effect is active.¹¹ The real interest rate ℓ is real!

5. Minimum Variance Stabilization Policies

We now return to the simple model (3.1) through (3.6) summarized in the stochastic difference equation (3.7). Provided the system is stable, the solution to (3.7) is

¹⁰ Actually Barro's tests provided further support for the NRH, since he could not reject the hypothesis that $\partial Y_t / \partial m_{t-1}^* = 0$. However, attention should be drawn to the fundamental critique of Barro's methodology raised by Blinder and Gordon in Fisher (ed., 1980, pp. 49-63).

¹¹ This was recognized long ago by Sargent (1973, p.443) and has recently been demonstrated by Brems (1982, chap. 4) within the framework of a long run "monetarist" growth model.

$$Y_t = Y^* + k_1 w_1^t + k_2 w_2^t + \sum_{j=0}^{t-1} \Omega_j z_{t-j}, \quad (5.1)$$

$$Y^* \equiv C_0 / (1 + C_1 + C_2), \quad z_t \equiv u_{1t} + v u_{t-1},$$

$$\Omega_j \equiv (w_1^{j+1} - w_2^{j+1}) / (w_1 - w_2)$$

where w_1 and w_2 are the characteristic roots of (3.7) and k_1 and k_2 are constants determined by the initial conditions Y_{-1} and Y_0 . Assume (naively?) that policy makers take the long view and wish to choose the stabilization parameters δ and μ so as to minimize the asymptotic variance of output given by

$$\lim_{t \rightarrow \infty} \sigma_Y^2(t) = E[(Y_t - Y_t^e)^2] \quad (5.2)$$

Here E denotes the expectation operator and $Y_t^e = Y^* + k_1 w_1^t + k_2 w_2^t$ is the expected value of output at time t .¹² Using the method described by Bartlett (1978) one finds from (3.7) that

$$\lim_{t \rightarrow \infty} \sigma_Y^2(t) = \sigma_z^2 (1 + C_2) / (1 - C_2) [(1 + C_2)^2 - C_1^2] \quad (5.3)$$

where σ_z^2 is of course the variance of z_t . Asymptotic output variance cannot be reduced to zero by choosing policy parameters so that $C_2 = -1$, since one of the stability conditions (3.8) and (3.9) would then be

¹²Remember from our assumptions about the u -terms that $E[z_t] = 0$ for all t . Note, also, that $Y_t^e = Y^*$ asymptotically, since the system is assumed to be stable. Thus, the goal of policy makers is to minimize the long run variability of Y_t around the equilibrium value Y^* .

violated. Given this restriction, the values of C_1 and C_2 which minimize (5.3) turn out to be $C_1 = C_2 = 0$. In other words, the authorities should choose policy parameters so as to offset the autoregressive structure of the system. In that case the stability conditions (3.8) through (3.10) will obviously be met, and $Y_t^e = Y^*$ for all t . From the definitions of C_1 and C_2 stated in (3.7) the values of δ and μ satisfying $C_1 = C_2 = 0$ are found to be

$$\delta = 1 - a - (b/\beta)(\alpha + \gamma) - \gamma b[(\lambda/\beta) + 1]/(1-\lambda) \quad (5.5)$$

$$\mu = \delta(\beta/b) + \alpha \quad (5.6)$$

It is interesting to note from (5.5) and (5.6) that the optimum values of δ and μ are not necessarily positive. This is not really surprising, considering our assumption that monetary and fiscal feedback policies can be implemented only with a time lag. If the economy is hit by an expansionary shock in period t driving up Y_t above $\bar{Y}$, it may be that inherent cyclical forces are making for a reversal of the output movement in period $t + 1$. Thus, if policy makers respond to the positive deviation of Y_t from $\bar{Y}$ by implementing contractionary policies in the following period, this may well add to total output variance and cause Y_{t+1} to undershoot equilibrium output. However, in the limiting case of the liquidity trap, we find from (5.5) that

$$\lim_{\beta \rightarrow \infty} \delta = [(1-\lambda)(1-a) - \gamma b]/(1-\lambda) = \theta/(1-\lambda) \quad (5.7)$$

Recalling the discussion of Section 4, we see from (5.7) and (5.6) that the optimum values of δ and μ will be positive ($\theta > 0$) under the same "Keynesian" circumstances which will ensure a "normal" short run response of output and inflation to discretionary fiscal and monetary policy. The Keynesian recommendation of genuine countercyclical stabilization policies is thus consistent with the traditional Keynesian view that the interest sensitivity of money demand (β) is high, that there is a long run tradeoff between inflation and unemployment (λ significantly below one) and that the interest sensitivity of investment (b) and the response of prices to excess supply (γ) are low, since all these factors make for positive optimum values of δ and μ .

Since the inflation rate varies with excess demand $Y_t - \bar{Y}$, one would expect that the policy parameters minimizing output variance will also minimize the asymptotic variance of inflation. In fact, the system (3.1) through (3.6) can be reduced to

$$\dot{p}_{t+2} + C_1 \dot{p}_{t+1} + C_2 \dot{p}_t = p_0 + x_{t+2}, \quad (5.8)$$

$$p_0 \equiv b[\gamma(\bar{m} + \mu\bar{Y}) + \mu(\eta - \gamma\bar{Y})]/\beta\theta$$

where x_{t+2} is a linear combination of (u_{t+2}, u_{t+1}, u_t) with the coefficients depending on the parameters of the model. From (5.8) the asymptotic variance of inflation is found to be

$\sigma_x^2(1+C_2)/(1-C_2)[(1+C_2)^2 - C_1^2]$, and this variance--like that of output--is minimized when $C_1 = C_2 = 0$. Thus there is no tradeoff between the variability of output and inflation although there is, of course,

a tradeoff between the mean values of these two variables, due to the Phillips curve (3.3).

It is natural to assume that the authorities wish to minimize the variance of output around its full-employment level. Under a minimum variance policy the mean value of Y_t will be $Y^* = C_0$, according to (5.1). Given the definition of C_0 stated in (3.7) and the minimum variance policy parameters (5.5) and (5.6), the condition $Y^* = C_0 = \bar{Y}$ will be met when monetary policy makers choose autonomous monetary growth $\bar{m}$ so that

$$\bar{m} = \eta/(1-\lambda) \quad (5.9)$$

With the minimum-variance full-employment policies (5.5), (5.6) and (5.9), the mean value of inflation determined by (5.8) becomes $p_0 = \eta/(1-\lambda) = \bar{m}$. For full employment to be compatible with price stability the Phillips curve parameter η must thus be zero. This would seem to require the absence of cost push inflation and of the "sectorinflation" described by Tobin (1972), according to whom the continuous random shifts in the composition of total demand are inflationary on average because of an asymmetric response of wages and prices to excess supply and demand in individual industries.

6. Summary

This paper has argued that although anticipated government demand management can probably affect output even if the NRH is valid, a successful exploitation of such nonneutrality for purposes of systematic output stabilization requires either that the government possess some information advantage or that short run wage and price rigidities assume

a specific form which will be reasonably stable over time. Given our present ignorance about the structure of the economy in general and the forms and causes of wage and price stickiness in particular, one would therefore have to show that the NRH is unrealistic to provide a convincing case for policy activism. We tried to do so by sketching models of competitive and noncompetitive wage and price determination that produce a tradeoff between the equilibrium rates of inflation and unemployment without relying on money illusion in the private sector. This tradeoff was then incorporated into a simple macroeconomic model with rational expectations and feed-back rules for fiscal and monetary policy. Within this framework we showed that anticipated fiscal and monetary policies will definitely have "real" effects. In our basic model the short run (first period) response of output and inflation to anticipated expansionary policies was seen to be positive for parameter values consistent with the traditional Keynesian view of the world. With the introduction of a real balance effect the likelihood of positive fiscal and monetary multipliers was found to increase, and anticipated money was shown to affect the real interest rate even if the NRH were valid. Returning to our basic model, we saw that government can always ensure stability and minimize the long run variability of output and inflation around their full-employment levels by appropriate activist stabilization policy rules. However, in the presence of lags in the implementation of policy, genuine countercyclical demand management was found to be optimal only in a rather "Keynesian" environment. Compatibility of the twin goals of full employment and price stability was found to be an unlikely special case.

Of course, none of these conclusions should be taken too literally, since they were derived from a simplified ad hoc model. Furthermore, even if the Phillips curve linking anticipated inflation to unemployment is downward sloping, it may indeed be very steep. Output variations induced by anticipated demand management may therefore be associated with very large variations of inflation. With respect to the possibility of buying a short run increase in output at a "reasonably" low inflation cost, the rational expectations revolution--as well as practical experience--has certainly taught us to be more pessimistic than we used to be in the heyday of Keynesianism. Activist demand management is hardly obsolete, but its potential is smaller than once believed.

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